We claim:

1. A nanowire strain gauge comprising:

a piezoresistive wire having a cross sectional area of the order of 100 nm^2 or less; and

means for measuring resistance change in the piezoresistive wire in response to a transverse force applied to the piezoresistive wire.

2. The nanowire strain gauge of claim 1 where the piezoresistive wire comprises a free standing nanowire clamped at opposing ends.

3. The nanowire strain gauge of claim 2 further comprising a biofunctionalized element suspended by and connected to the free standing nanowire.

4. The nanowire strain gauge of claim 1 further comprising a flexure element and where the piezoresistive wire comprises an embedded piezoresistive wire in the flexure element.

5. The nanowire strain gauge of claim 4 where the flexure element comprises at least one arm in a notched nanocantilever.

6. The nanowire strain gauge of claim 1 further comprising a flexure element and where the piezoresistive wire comprises an array of piezoresistive wires embedded in the flexure element.

7. The nanowire strain gauge of claim 1 where the piezoresistive wire comprises a thin metal film.

8. The nanowire strain gauge of claim 7 where the thin metal film comprises a film with a thickness of the order of tens of angstroms or less.

9. The nanowire strain gauge of claim 7 where the thin metal film has a thickness such that the film comprises a discontinuous metal island structure.

10. The nanowire strain gauge of claim 8 where the thin metal film comprises a pure metal composition selected from the group consisting of Au, Cr, Ag, Pd, Ni, Pt, Mn and alloys, Au-Ni, NiCr, Bi-Sb, Ag-Ni, Cu-Ni, and Pt-Cr.

11. The nanowire strain gauge of claim 4 where the piezoresistive wire comprises a thin metal film included in a bimorph structure comprised of a top layer comprised of the thin metal film and a bottom layer comprised of a higher resistive metal layer than the top layer, a semiconductor layer or an insulating layer.

12. The nanowire strain gauge of claim 1 where the piezoresistive wire comprises doped crystalline silicon.

13. The nanowire strain gauge of claim 1 where the piezoresistive wire comprises doped silicon carbide.

14. The nanowire strain gauge of claim 1 where the piezoresistive wire comprises doped GaAs.

15. The nanowire strain gauge of claim 1 where the piezoresistive wire comprises doped $Ga_xAl_{1-x}As$, where $0 < x < 1$.

16. The nanowire strain gauge of claim 1 where the piezoresistive wire comprises a doped AlGaN/GaN, AlN/GaN/InN or GaN/AlN/GaN heterostructure.

17. A nanowire strain gauge comprising:

a free standing piezoresistive nanowire having a cross sectional area of the order of 100 nm^2 or less and clamped at opposing ends; and

means for measuring resistance change in the piezoresistive wire in response to a transverse force applied to the piezoresistive wire.

18. The nanowire strain gauge of claim 17 further comprising a biofunctionalized element suspended by and connected to the free standing nanowire.

19. The nanowire strain gauge of claim 17 where the piezoresistive wire comprises a thin metal film with a thickness of the order of tens of angstroms or less, doped crystalline silicon, doped silicon carbide, doped GaAs, doped $Ga_xAl_{1-x}As$, where $0 < x < 1$, or a doped AlGaN/GaN, AlN/GaN/InN or GaN/AlN/GaN heterostructure.

20. A nanowire strain gauge comprising:

a flexure element;

a piezoresistive wire embedded in the flexure element, the piezoresistive wire having a cross sectional area of the order of 100 nm^2 or less;

means for measuring resistance change in the piezoresistive wire in response to a transverse force applied to the piezoresistive wire.

21. The nanowire strain gauge of claim 20 further comprising a plurality of piezoresistive wires forming an array of embedded piezoresistive wires in the flexure element.

22. The nanowire strain gauge of claim 20 where the piezoresistive wire comprises a thin metal film included in a bimorph structure comprised of a top layer comprised of the thin metal film and a bottom layer comprised of a higher resistive metal layer than the

top layer, a semiconductor layer or an insulating layer, doped crystalline silicon, doped silicon carbide, doped GaAs, doped $Ga_xAl_{1-x}As$, where $0 < x < 1$ or a doped AlGaN/GaN, AlN/GaN/InN or GaN/AlN/GaN heterostructure.

23. A method of measuring strain at nanoscales comprising:

providing nanowire strain gauge comprised of a piezoresistive wire having a cross sectional area of the order of 100 nm^2 or less;

stressing the piezoresistive wire with a force having a transverse component; and

measuring resistance change in the piezoresistive wire in response to the transverse component of the force applied to the piezoresistive wire.

24. The method of claim 23 where providing nanowire strain gauge comprised of a piezoresistive wire comprises providing a free standing nanowire clamped at opposing ends and where stressing the piezoresistive wire comprises applying the force to the nanowire between the opposing ends.

25. The method of claim 24 further comprising reacting a biofunctionalized element suspended by and connected to the free standing nanowire with a target molecule, oscillating the nanowire at a resonant frequency, and measuring modification of the resonant frequency of the nanowire due to the reaction with the target molecule.

26. The method of claim 13 further comprising providing a flexure element in which the piezoresistive wire comprises an embedded piezoresistive wire so that stressing the piezoresistive wire comprises stressing the flexure element.

27. The method of claim 26 where providing a flexure element comprises providing at least one arm in a notched nanocantilevers to serve as the flexure element.

28. The method of claim 23 further comprising providing a flexure element and where the piezoresistive wire further comprises an array of piezoresistive wires embedded in the flexure element.

29. The method of claim 23 where providing nanowire strain gauge comprised of a piezoresistive wire comprises a thin metal film.

30. The method of claim 29 where providing the thin metal film comprises providing a film with a thickness of the order of tens of angstroms or less.

31. The method of claim 29 where providing the thin metal film provides a film with a discontinuous metal island structure.

32. The method of claim 30 where providing the thin metal film comprises providing a film with a pure metal composition selected from the group consisting of Au, Cr, Ag, Pd, Ni, Pt, Mn and alloys, Au-Ni, NiCr, Bi-Sb, Ag-Ni, Cu-Ni, and Pt-Cr.

33. The method of claim 26 where providing the piezoresistive wire comprises providing a thin metal film included in a bimorph structure comprised of a top layer comprised of the thin metal film and a bottom layer comprised of a higher resistive metal layer than the top layer, a semiconductor layer or an insulating layer.

34. The method of claim 23 where providing the piezoresistive wire comprises providing doped crystalline silicon.

35. The method of claim 23 where providing the piezoresistive wire comprises providing doped silicon carbide.

36. The method of claim 23 where providing the piezoresistive wire comprises providing doped GaAs.

37. The method of claim 23 where providing the piezoresistive wire comprises providing doped $Ga_xAl_{1-x}As$, where $0 < x < 1$.

38. The method of claim 23 where providing the piezoresistive wire comprises providing a doped AlGaN/GaN, AlN/GaN/InN or GaN/AlN/GaN heterostructure.